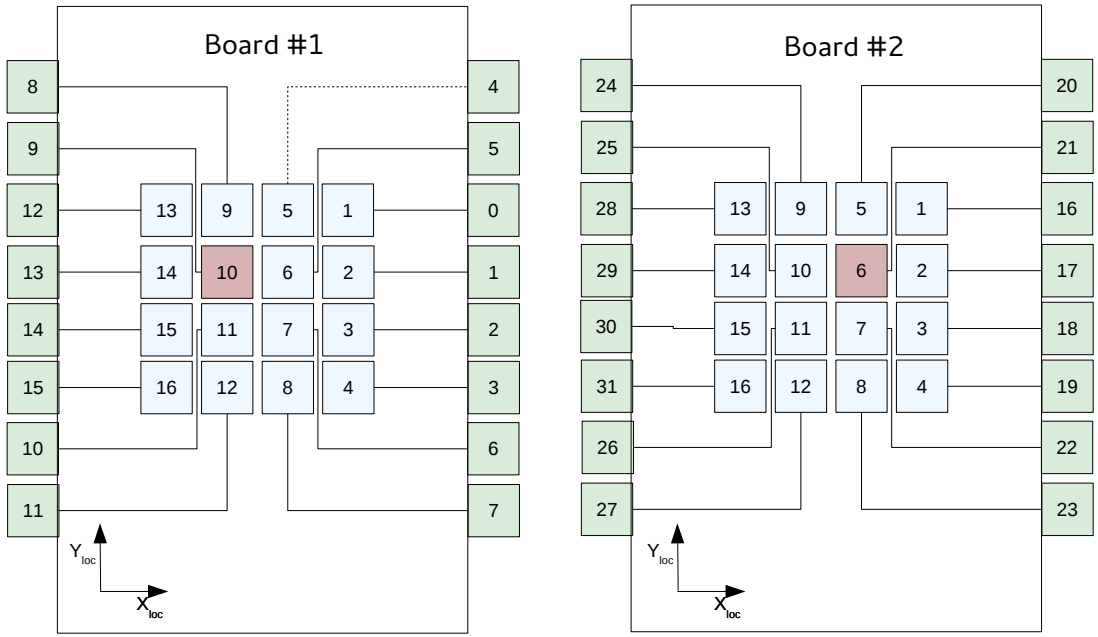
PET32 prototype: initial data study

S.Foulkes, S.Los, **P.Murat**, A.Ronzhin, E.Ramberg (Fermilab)

April 10, 2012

Introduction

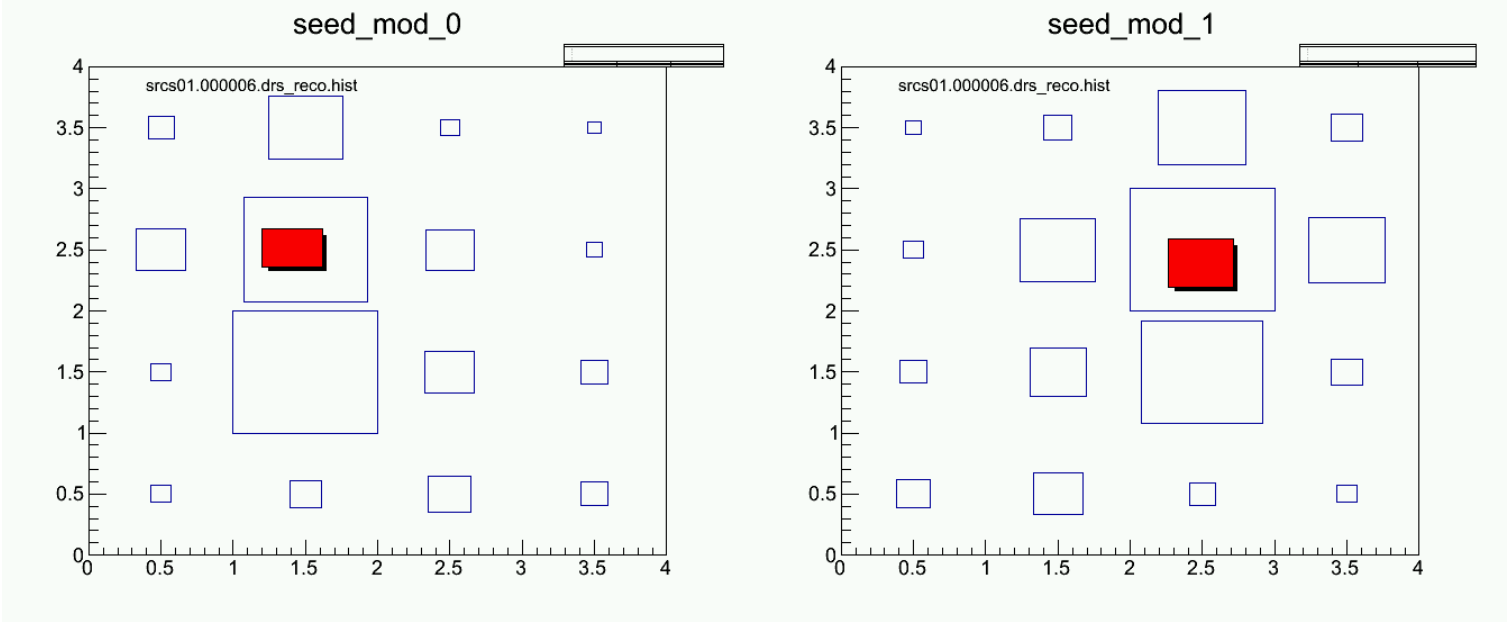
- DRS4 amplitude calibration OK
- pedestals subtracted
- cable mapping fixed
- trigger: coincidence of channels 9 and 21



•Color map:
- blue: individual SiPM's from 11064 matrices
- Green: CAEN V1742 readout channels
- Red: channels used to make the trigger coincidences

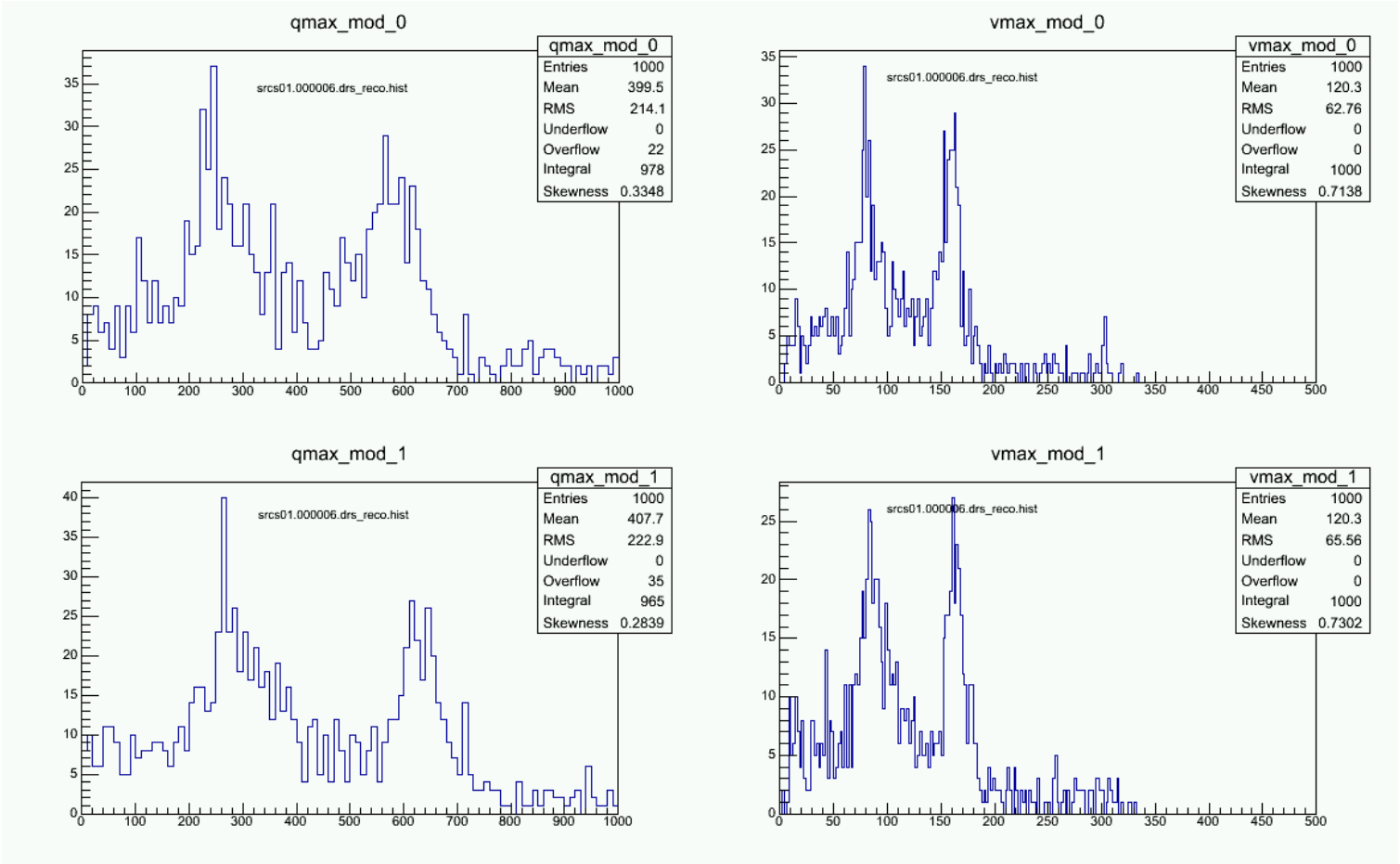
•Trigger: MPPC#1(10) & MPPC#2(6), which is channel#9 & channel#21
•Cabling: channel#N <---> cable#(N+1))

Seed channel position for 1000 events



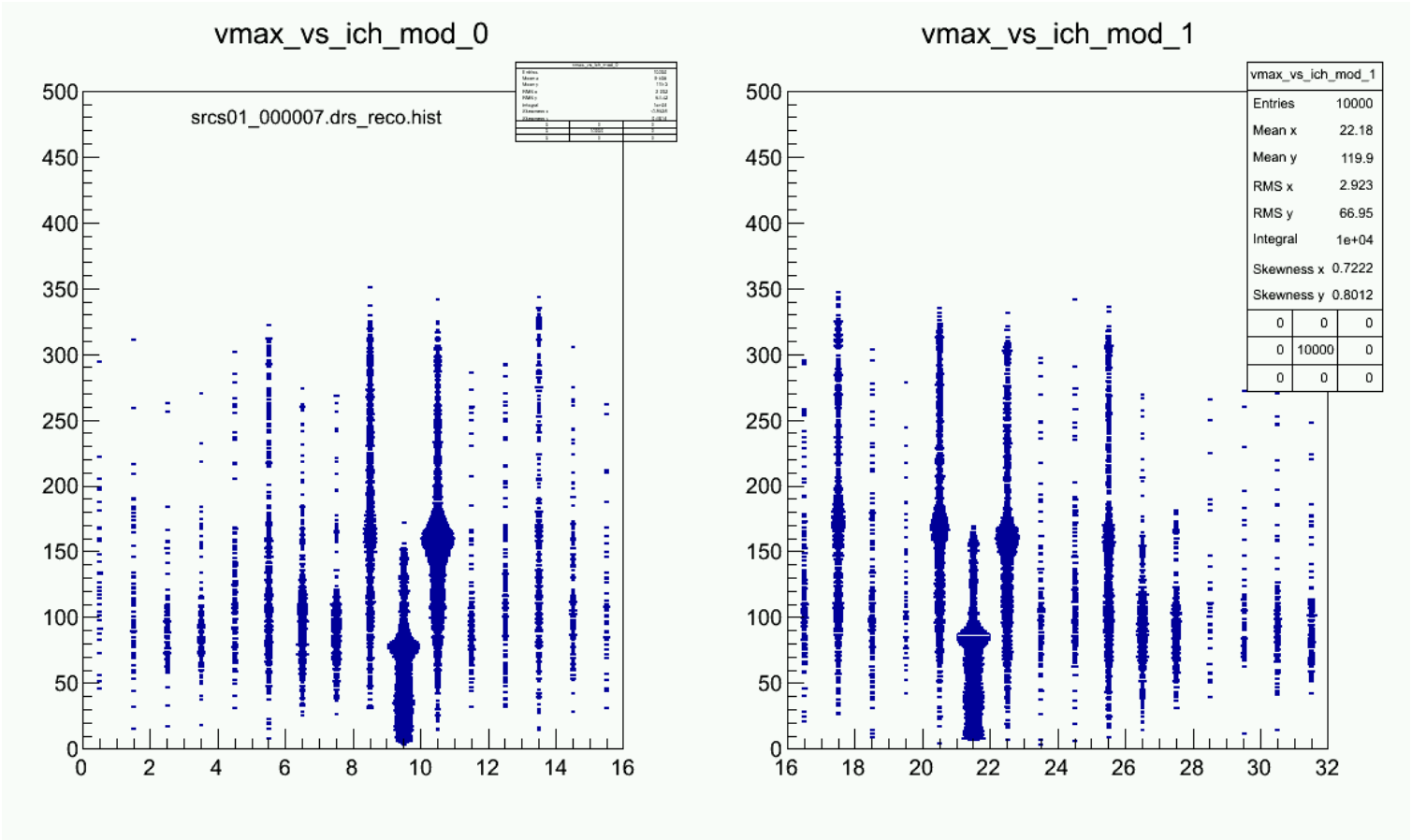
- trigger channels marked with red rectangles
- seed channel occupancy looks very reasonable
- a bit of concern: channel 9 has less entries than channel 10.
- could be due to by misalignment

Pulse height and charge in the seed channel



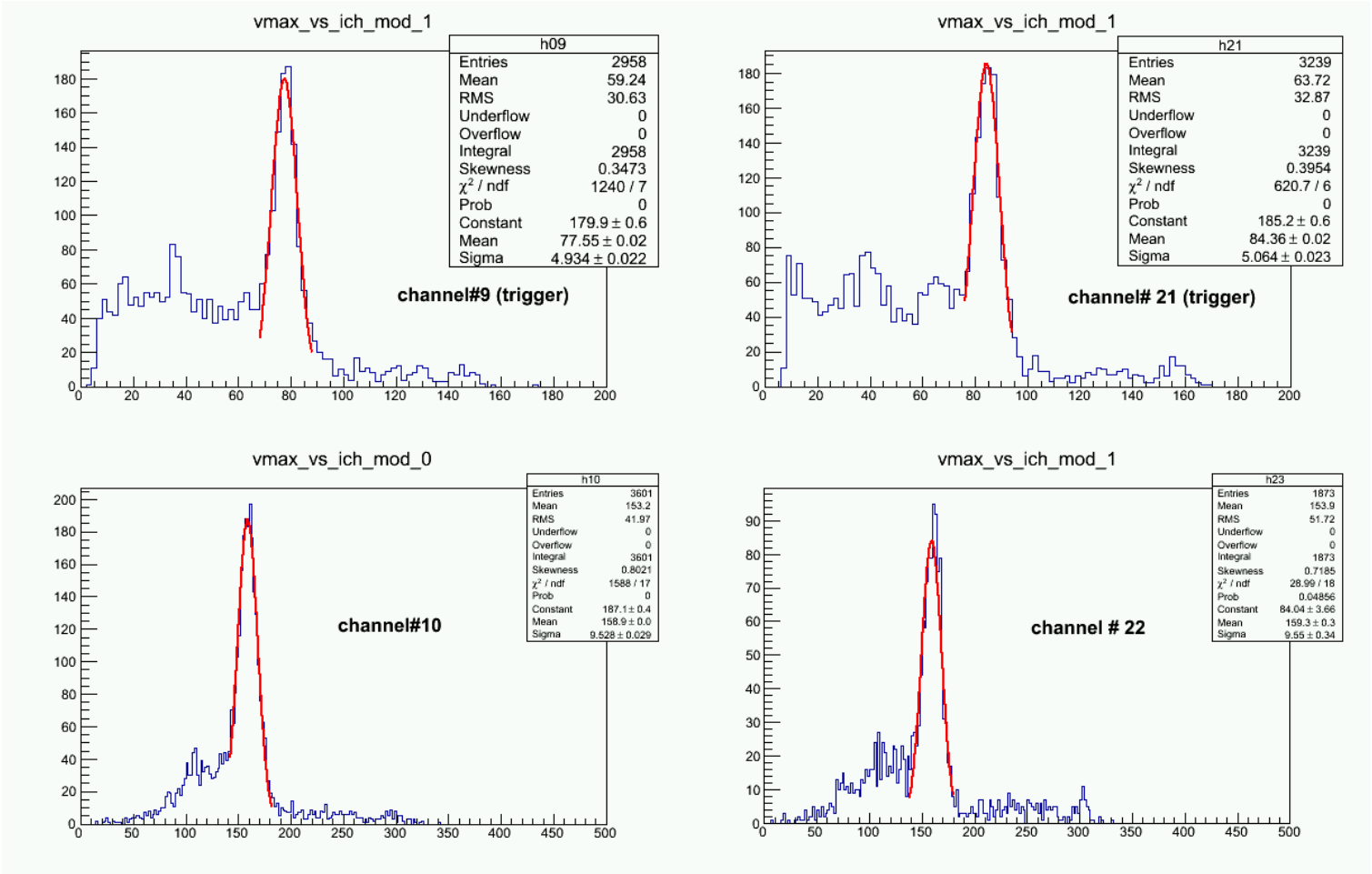
- 2 peak structure - what is it?
- pulse height distributions show better resolution in the photopeak.
- to improve resolution in the integrated charge need to increase the trigger delay - see coming slides

Pulse height vs channel number



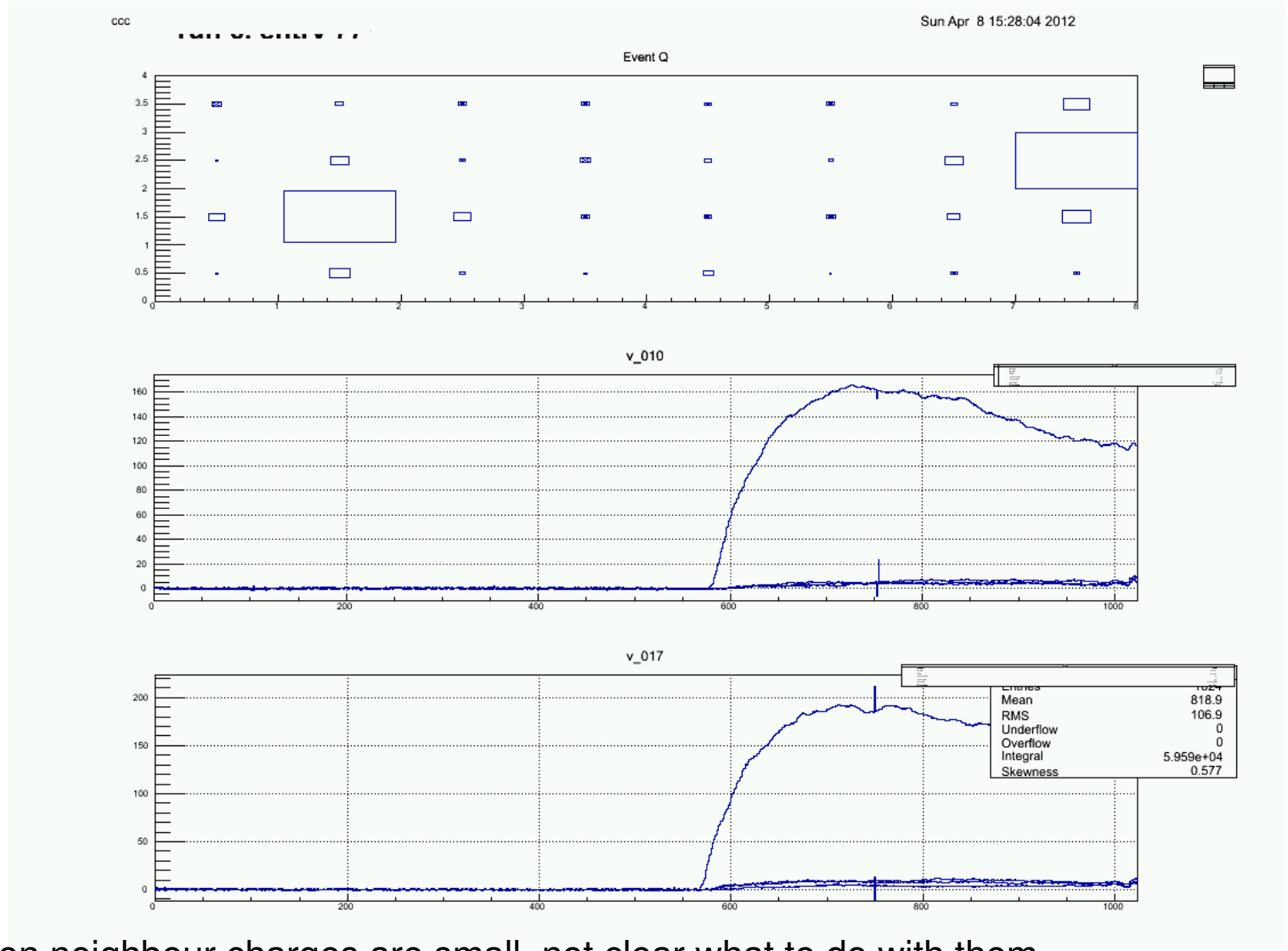
- left: module#1, right: module#2
- trigger channels have 2 times lower peak value - the signal is divided!
- need an OR of 16 channels on each side for triggering

Energy resolution in the photopeak



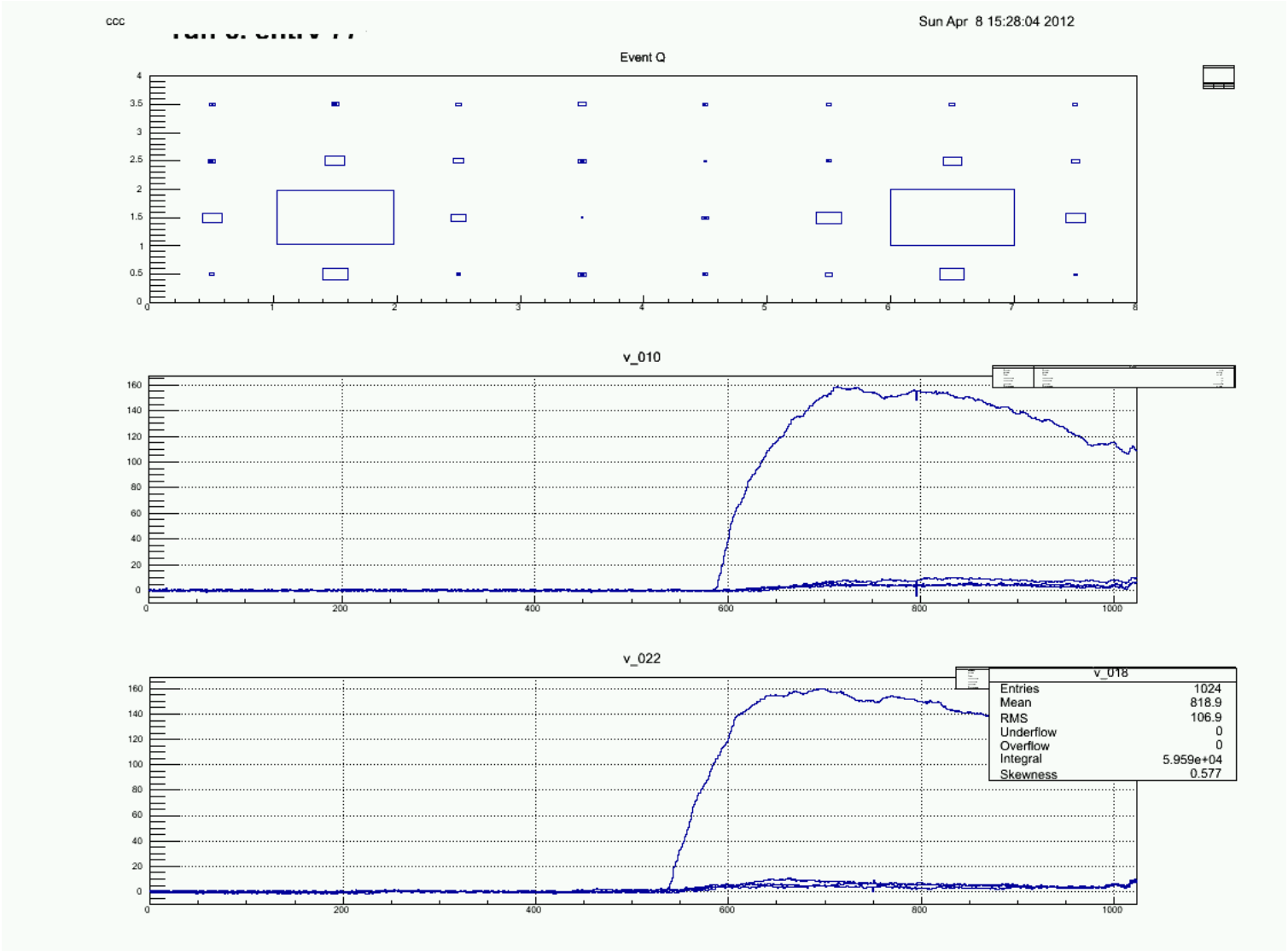
- left: module#1, right: module#2
- energy resolution in the photopeak about 15% , with the single crystals saw 10%
- crystal misalignment?

Run 6 event 79: a simple event



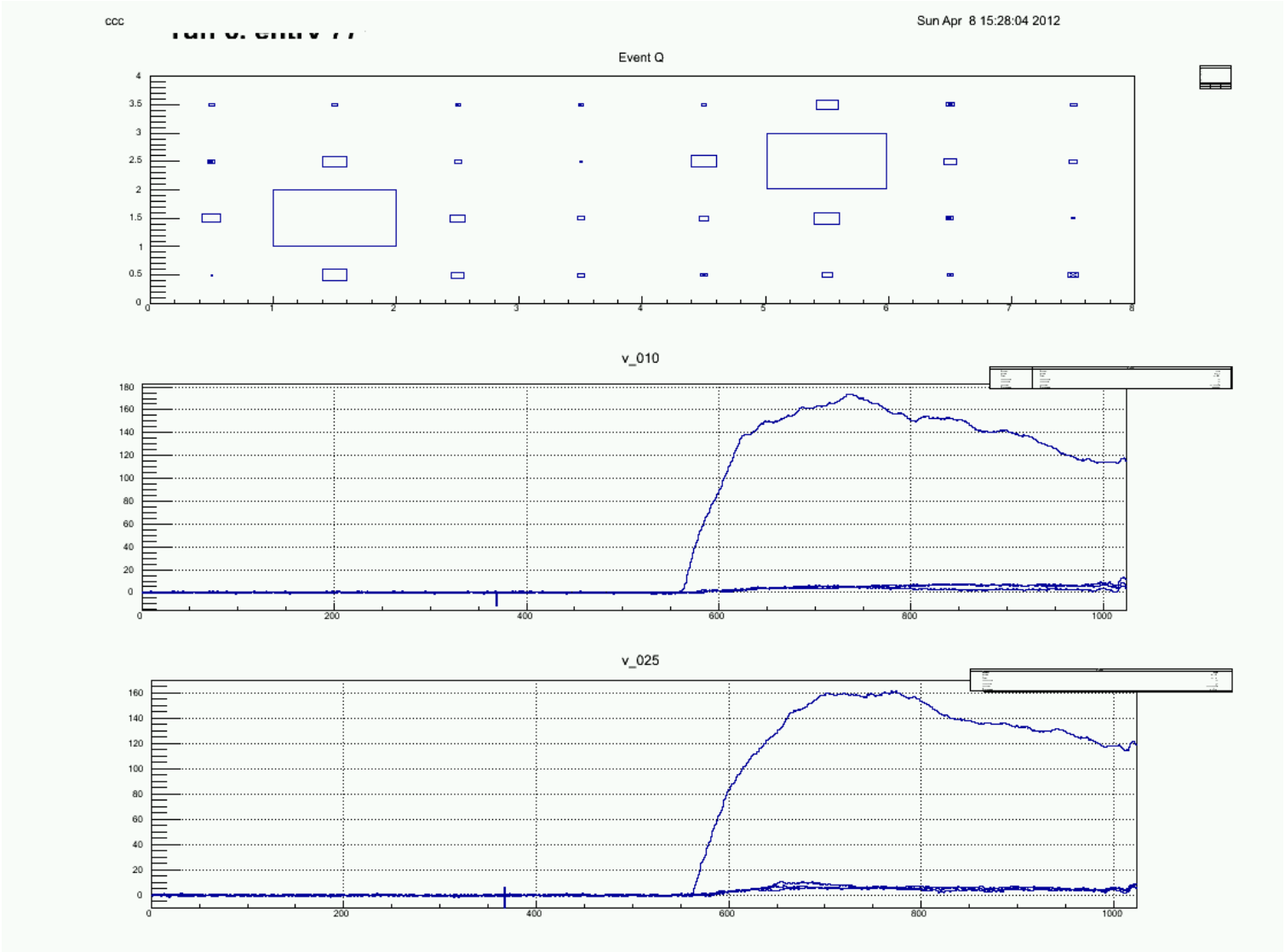
- when neighbour charges are small, not clear what to do with them
- given they all are of the same order, cross-talk comes to mind
- GEANT4-base simulation would be extremely helpful

Run 6 event 83 : Good Event



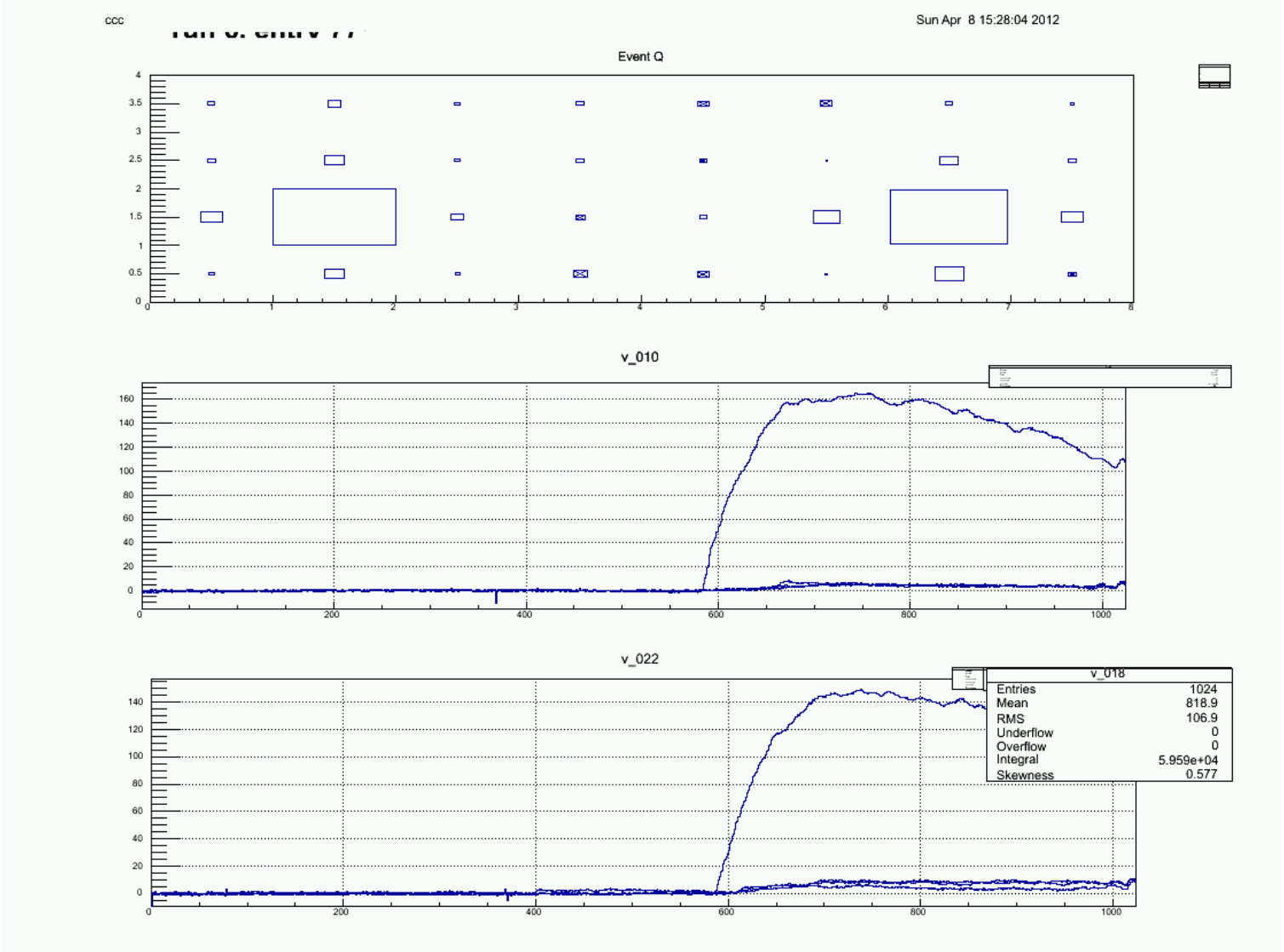
- example of a good event
- it is enough to read 350-400 channels (70-80 ns)

Run 6 event 91 - also good



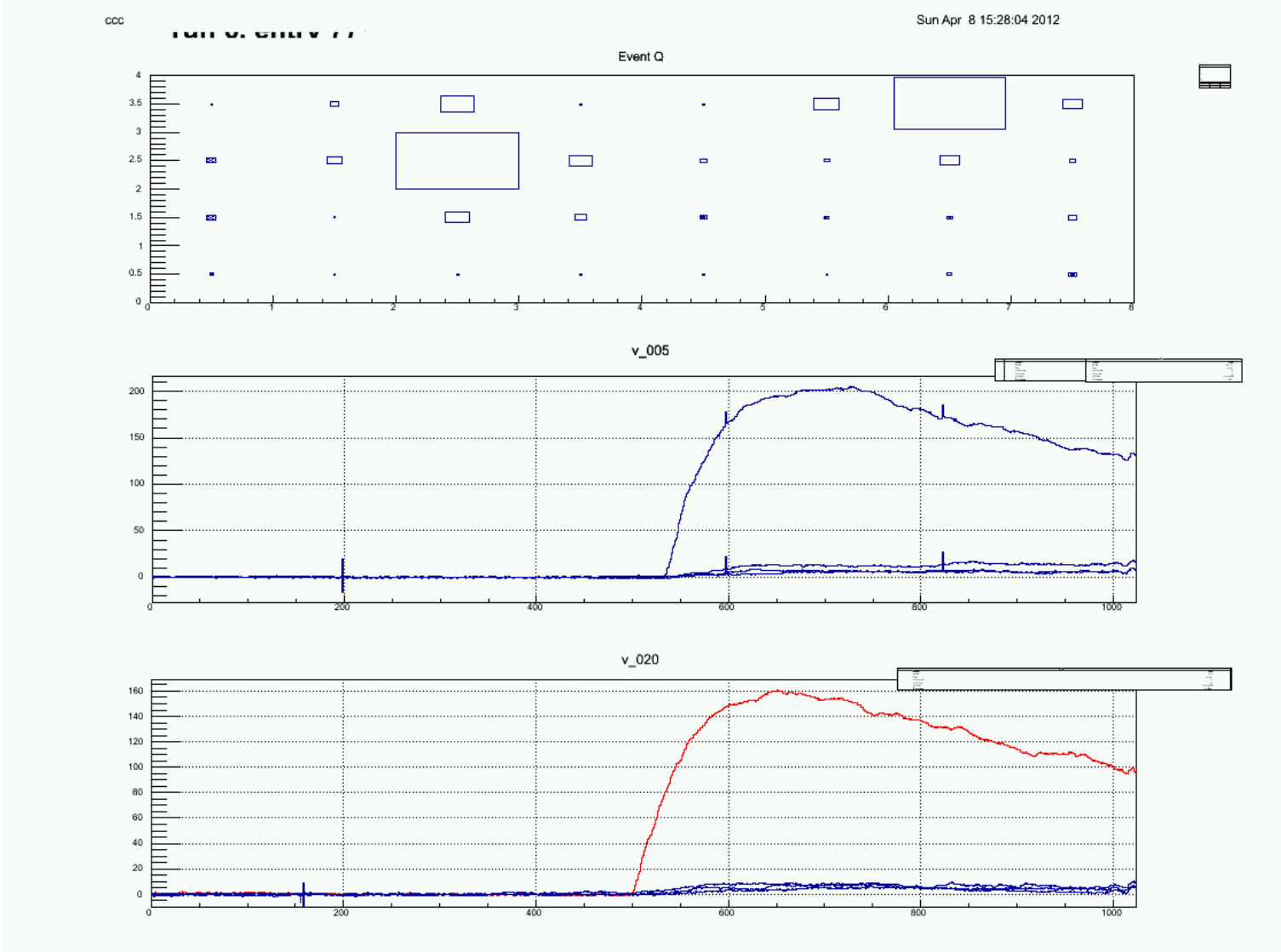
- ...

Run 6 event 92



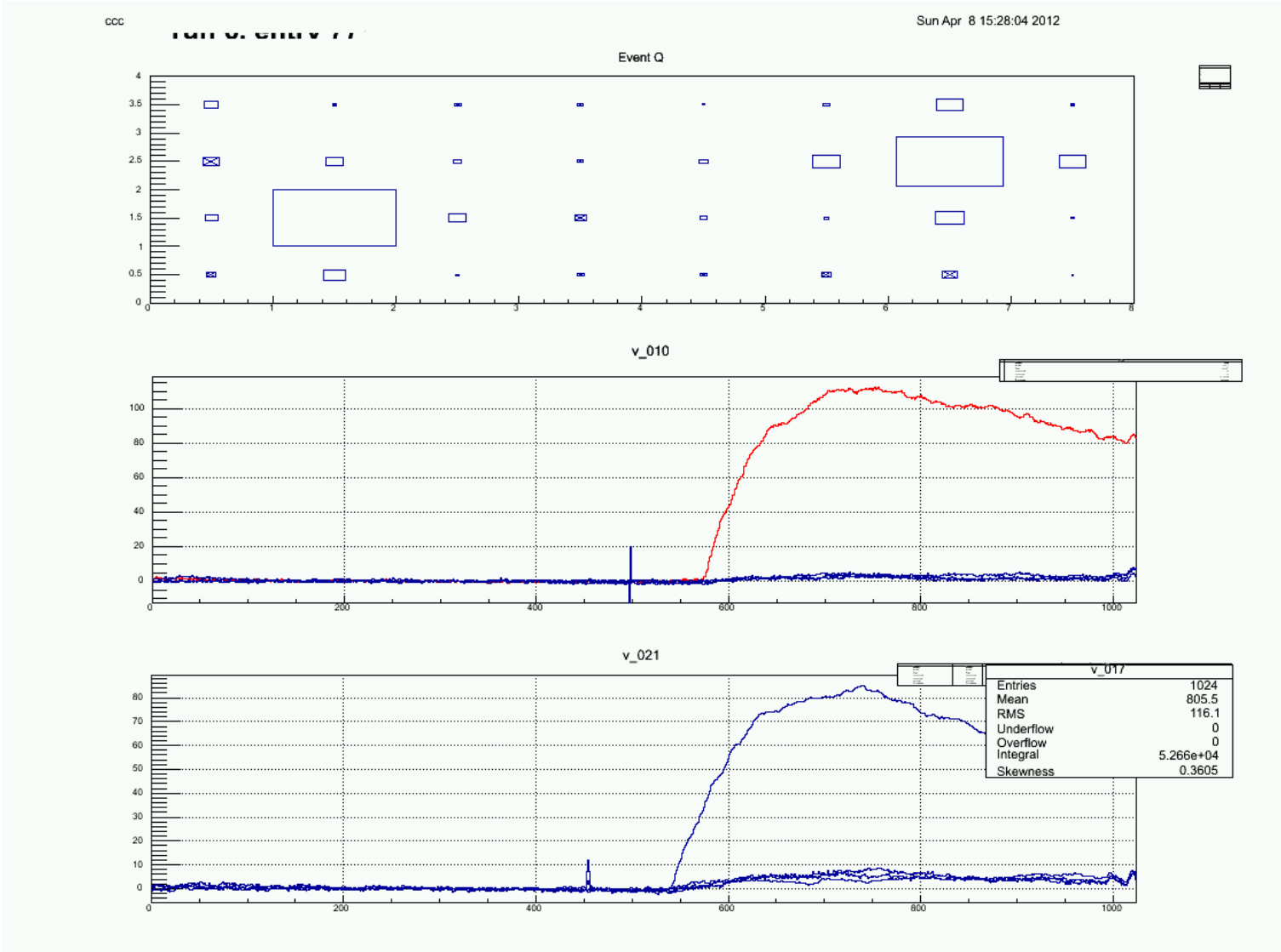
- a good and simple event

Run 6 event 102: good event



- another example of a simple event

Run 6 event 103: one more good event

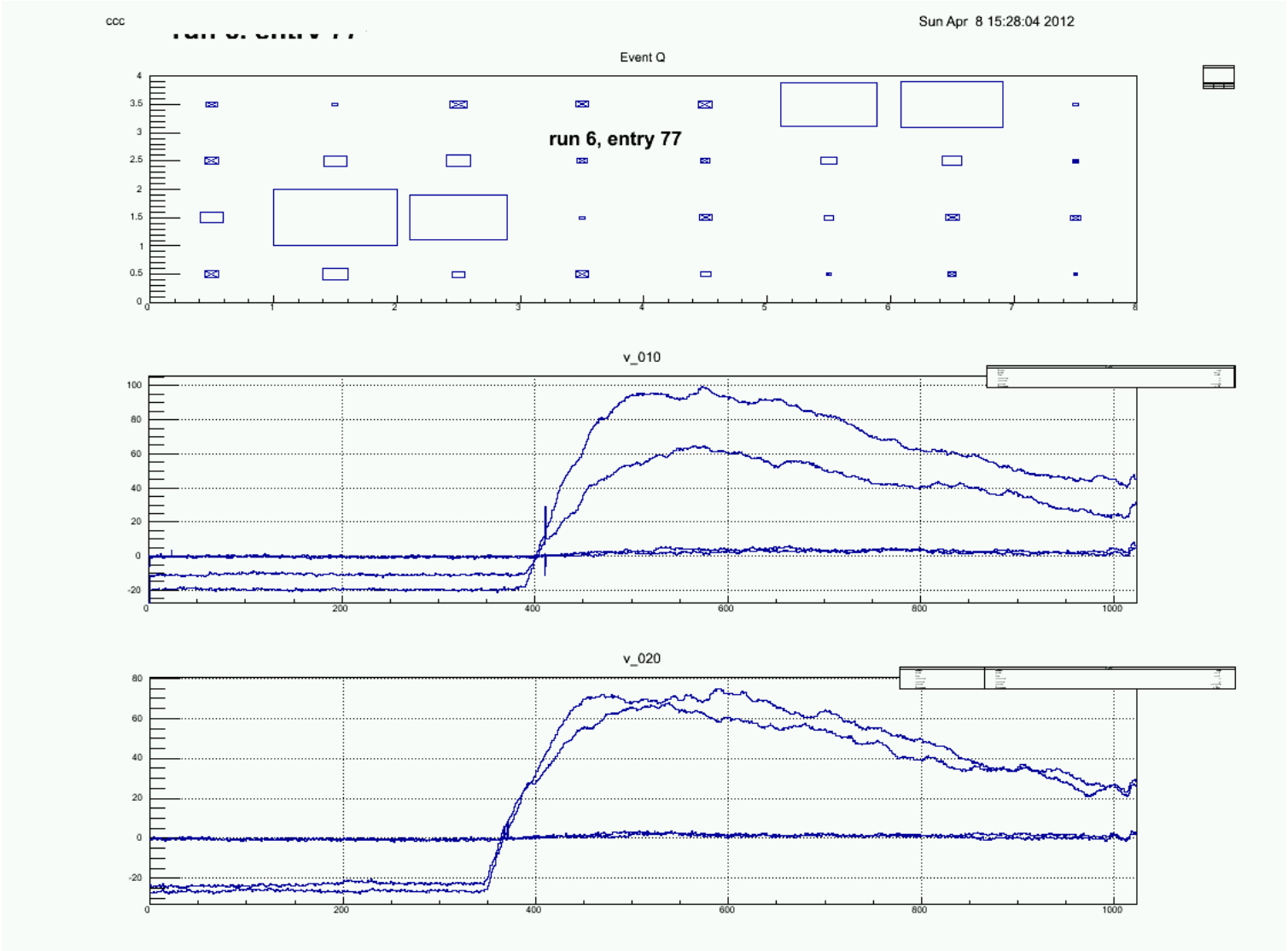


- cross-talk at the level below 10-15%, does it depend on overvoltage?
- a stripline-based readout would merge all neighbouring pulses into one

Run 6 event 87: different T0's?

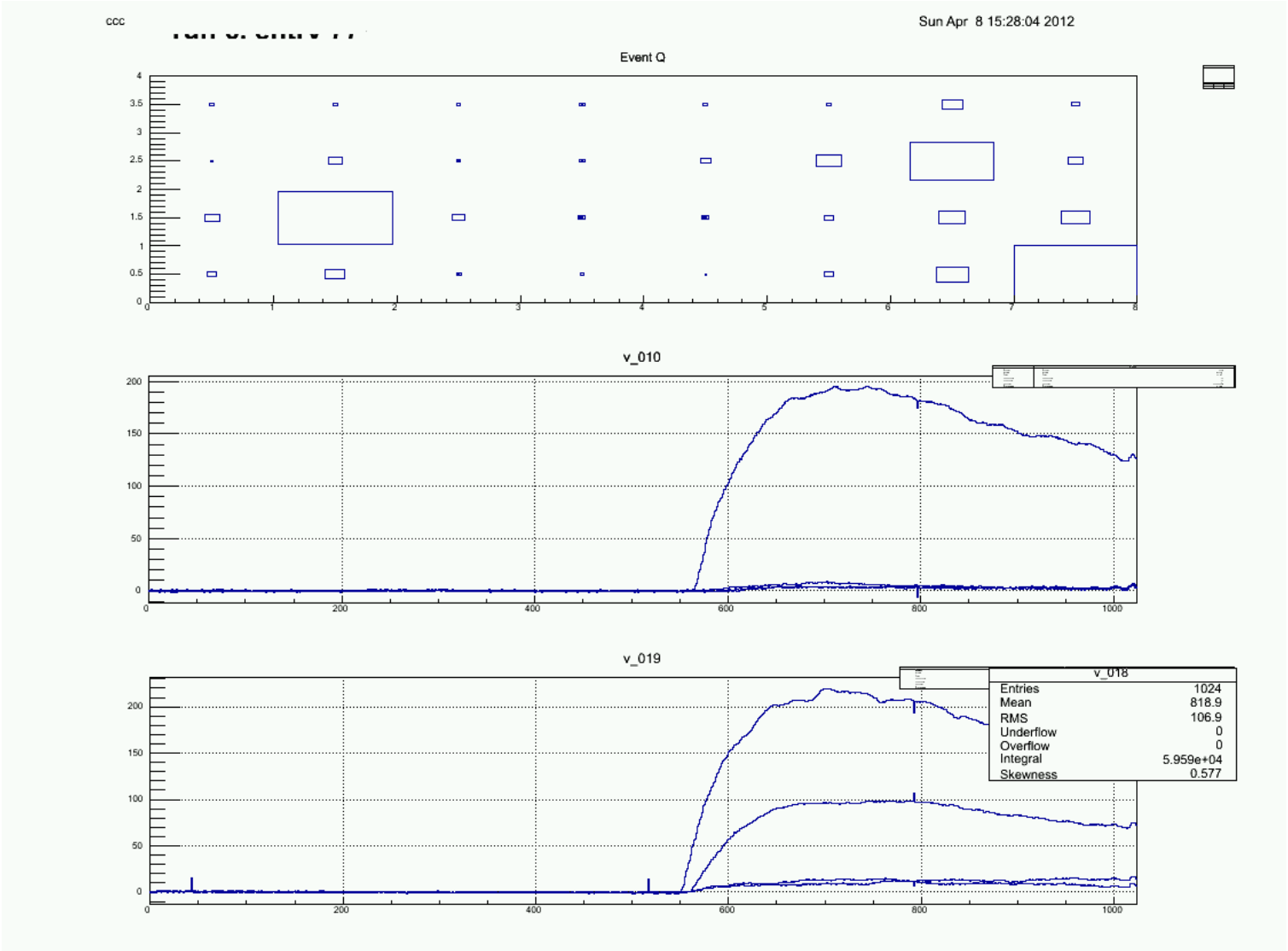
- Compton scattering ?
- thinking of adding charges in the 2 neighbouring crystals

Run 6 event 77: different pedestals



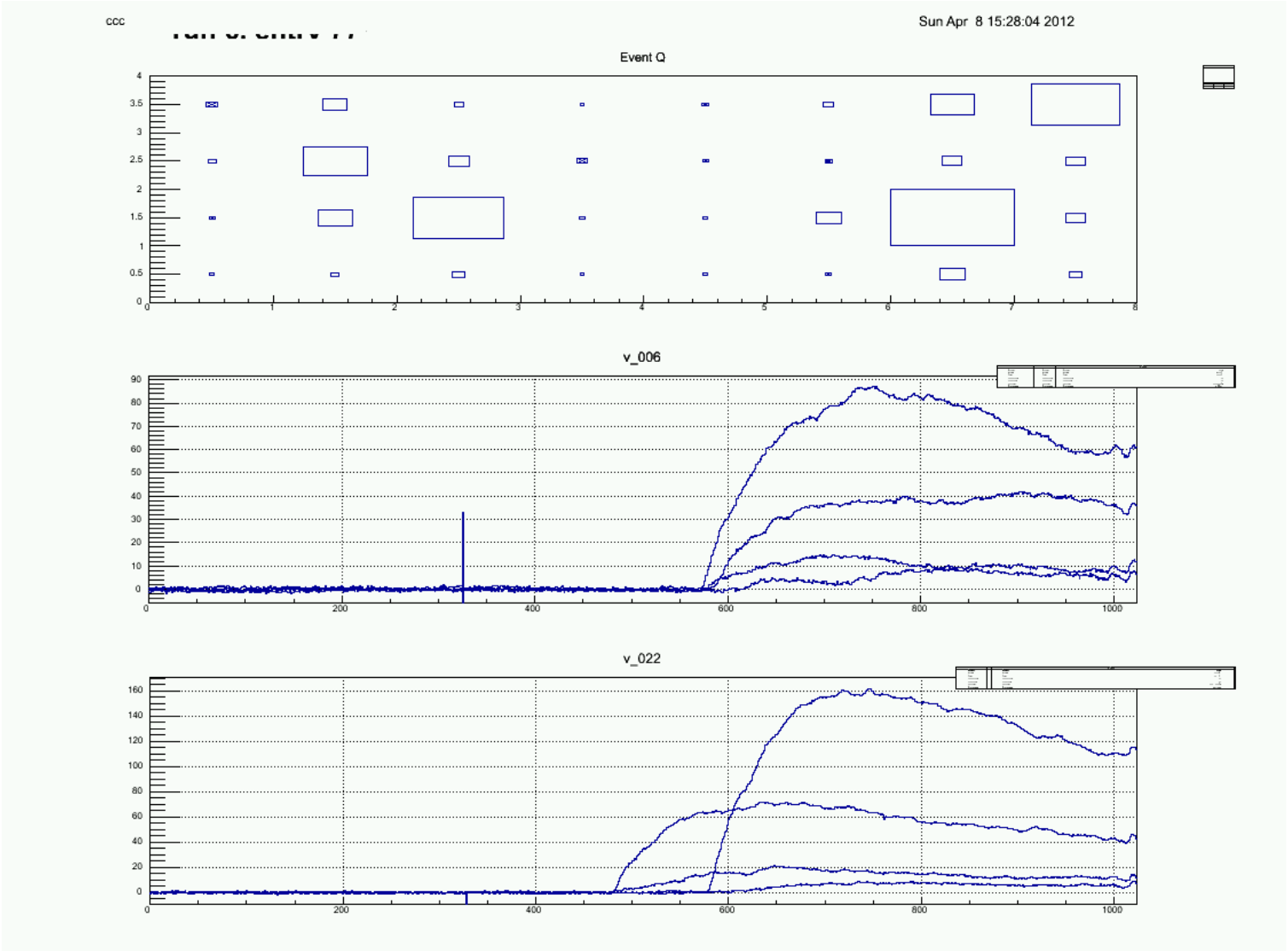
- compton scattering or a photoelectron?
- adding charges looks sensible

Run 6 event 80:



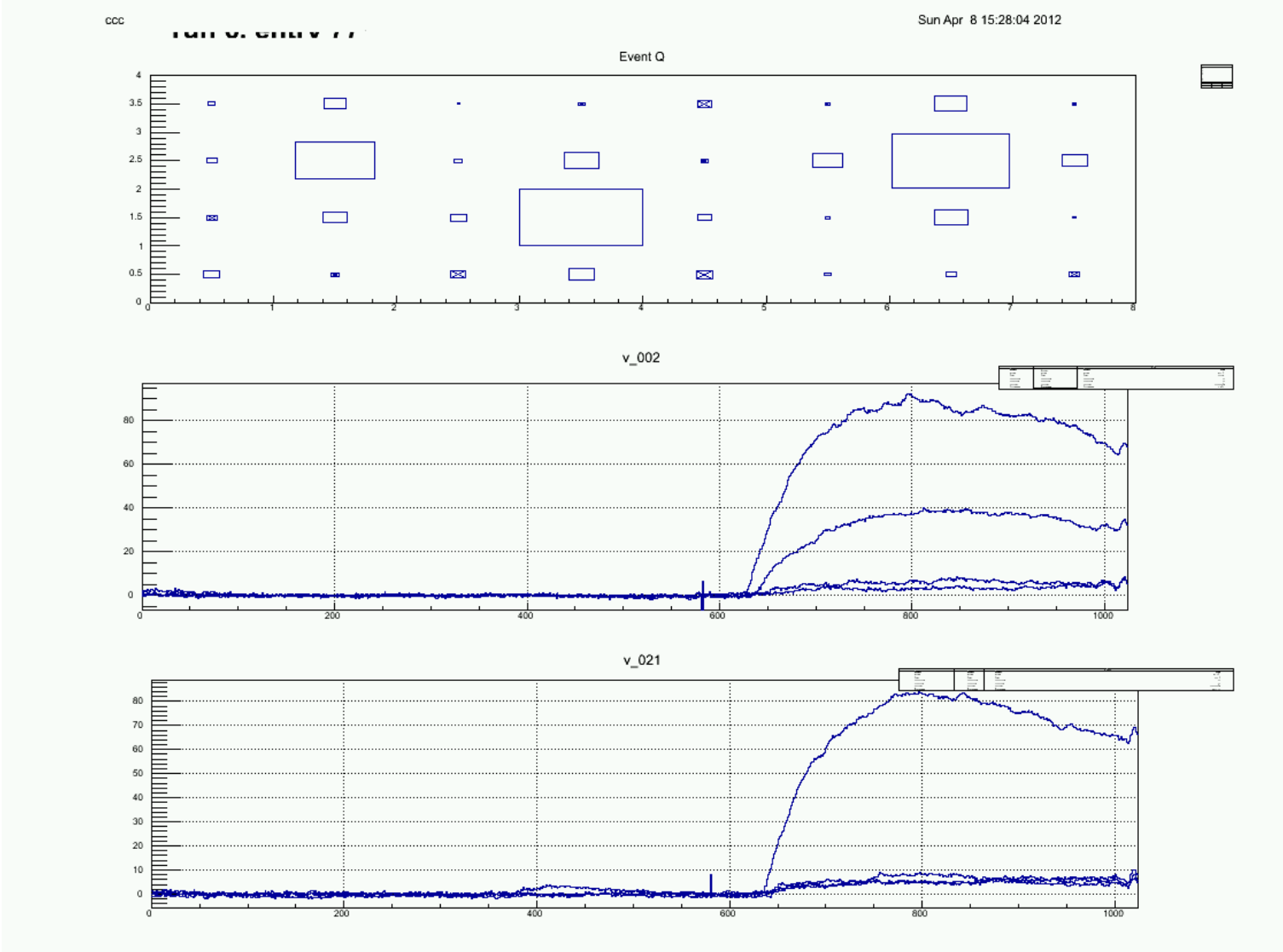
- 2nd (right) array: 2 crystals with large pulses far from each other.
- pulses seem to have the same time

Run 6 event 82: overlapping events?



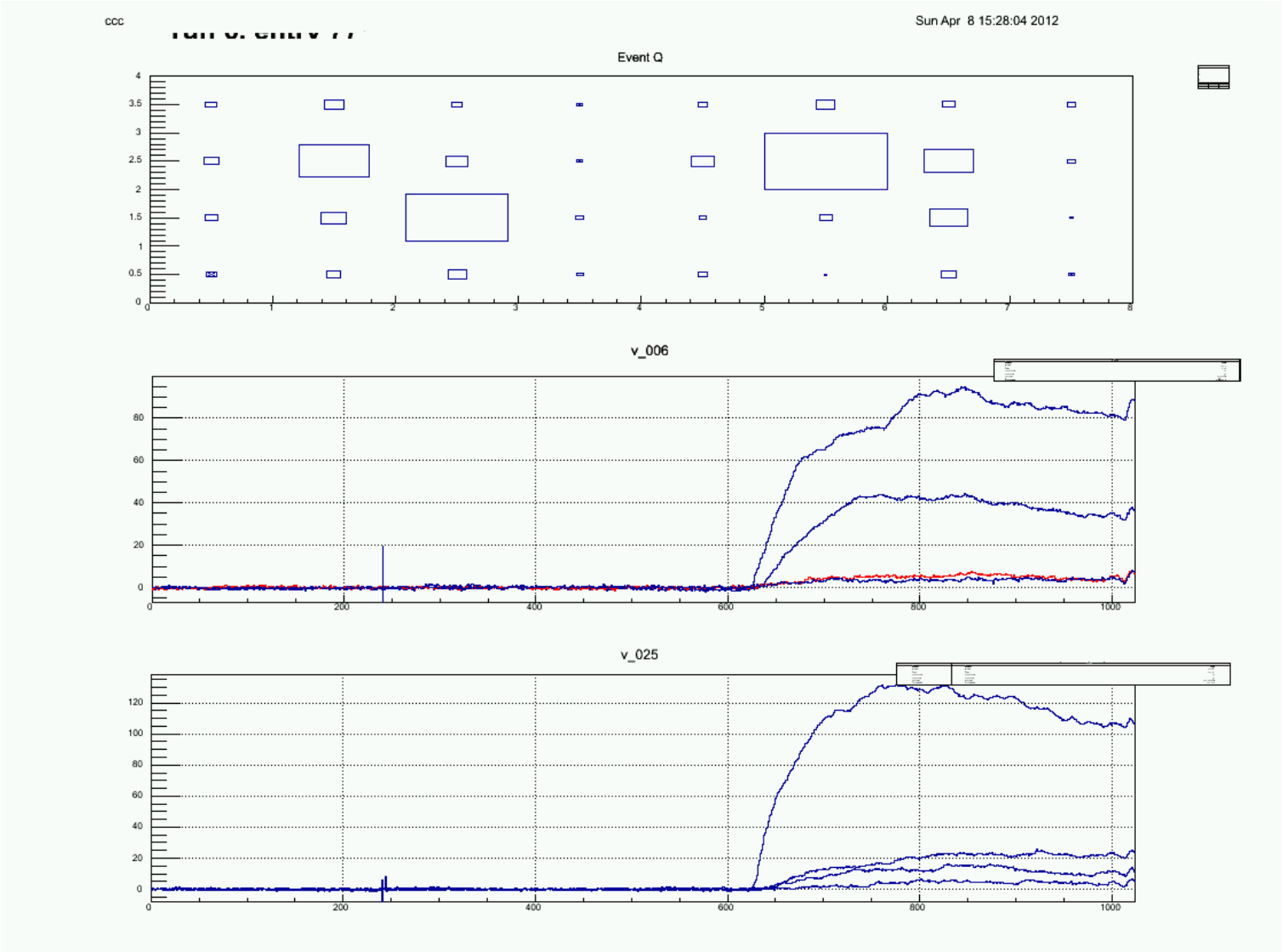
- another compton event (left array) ?
- right array: different decays ?

Run 6 event 97: cross-talk?



- array #1: seemingly unconnected clusters, correlated timing

Run 6 event 104: need T0 calibration



- need T0 calibration
- can try 3x3 clusters, first - for charge only

Summary

- channel-to-channel cross talks seem to be at 10-15% level
- GEANT4 MC would be very useful
- what are the zero voltage shifts, common for groups of channels?
- T0 calibration
- try 3x3 clusters, first - for charge only
- a real trigger based on OR of 16 channels from each side
- increase the trigger delay ...